



Research article

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Revision of the genus *Georissus* (Coleoptera, Hydrophiloidea, Georissidae) of Japan

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Abstract. Japanese species of the genus *Georissus* are revised. Seven species, including two new, *G. (Neogeorissus) takahashii* sp. nov. and *G. (Ne.) satoi* sp. nov. are recognized. *Georissus (Neogeorissus) sakaii* Satô, 1972 and *G. (Ne.) katsuoii* Nakane, 1995 are synonymized with *G. (Ne.) japonicus* Satô, 1972. Based on the type series and additional specimens, three subgenera and seven species are (re) described with SEM micrographs of the external morphology and figures of male and female genitalia. The terminology of some structures of the head and the pronotum are redefined for convenience of taxonomy. A key to the Japanese species is also given.

Keywords. Minute mud-loving beetle, taxonomy, new species, new synonym, faunistics.

Yasuda K. & Yoshitomi H. 2022. Revision of the genus *Georissus* (Coleoptera, Hydrophiloidea, Georissidae) of Japan. *European Journal of Taxonomy* 817: 111–142. <https://doi.org/10.5852/ejt.2022.817.1767>

Introduction

Georissus Latreille, 1809, the only genus in the family Georissidae Laporte, 1840, is distributed in all zoogeographic regions except the Antarctic, and is represented by 83 species (Hansen 1999; Short & Hebauer 2006; Fikáček & Falamarzi 2010; Short & Fikáček 2011; Fikáček 2019). This family was considered by historical authors (e.g., Erichson 1847) to be related to different Coleopteran families like Dryopidae Billberg, 1820 (Byrrhoidea). Crowson (1950) transferred this family to Hydrophiloidea Latreille, 1802 based on the adult morphology, and van Emden (1956) described the larva of *Georissus crenulatus* (Rossi, 1794). Since then, this family has been placed in Hydrophiloidea (Beutel & Leschen 2005; Bocák *et al.* 2014; McKenna *et al.* 2015). Phylogenetic analysis based on morphology placed this family as a sister to Epimetopidae Zaitzev, 1908 (Beutel 1994; Fikáček *et al.* 2021), but molecular analysis placed it close to Helophoridae Leach, 1815 (Short & Fikáček 2013; Fikáček *et al.* 2021). Three subgenera, *Georissus*, *Neogeorissus*, and *Nipponogeorissus* were defined by Sato (1972) based on the study of Japanese species, and this concept was accepted by subsequent authors (e.g., Hebauer 2004; Fikáček 2019). The biology of this family was studied in European (Messner 1965, 1972) and

North American (Shepard 2003) species, but other species have not been investigated (Fikáček 2019). The adults and larvae usually inhabit sandy or muddy banks of rivers, and standing water (Satô 1972; Shepard 2003; Shepard & Sites 2016), and some species live in tidal flats (Akita 2008; Fikáček *et al.* 2012) or in leaf litter (Fikáček 2012). Some adults are capable of flying and are attracted to light (Arai 2006; Shepard & Sites 2016).

Japanese species of the genus *Georissus* were revised by Satô (1972, 1981), and seven species under three subgenera are recorded (Sharp 1888; Nakane 1963, 1966, 1995; Satô 1972, 1981). However, no taxonomical studies have been conducted so far. The members of this group in Japan are rarely collected because of their small body and little-sampled habitat. Thus, a limited number of specimens were used for previous studies. In the present paper, we review the Japanese *Georissus* based on a large number of additional specimens with observation of the male and female genitalia.

Material and methods

Dry specimens were prepared by soaking the whole body in hot water for about one hour. They were then soaked in a hot solution of neutral detergent for a few hours to remove dirt and sand from the specimens. Photographs were taken under a Leica MZ95 using a microscopy camera system (Nikon DS-Fil-L2) and combined using the Combine ZP (Alan Hadley, UK) automontage software. Some structures (Figs 1, 5–8) were observed using a SEM (JSM-5600LV) and images were enhanced using Adobe® Photoshop CC. The mouth parts and genitalia were removed with forceps under a Leica MZ95 stereo microscope.

Terminology follows mainly Fikáček & Falamarzi (2010), Lawrence *et al.* (2011), and Archangelsky *et al.* (2016), and the structures of the head and pronotum are redefined as in Fig. 1.

Abbreviations

Morphological abbreviations used for measurements are as follows:

- EL = length of elytra along the suture
- EW = maximum width of elytra
- PL = length of pronotum in median line
- PW = maximum width of pronotum
- TL = total length (PL + EL)

Some structures on head, pronotum and ventrites are abbreviated as follows (see also Figs 1A–B, 8A):

- cd* = central depression; large fovea on antero-median portion of pronotum
- lsa* = lateral smooth area; smooth area of frons
- pg* = posterior groove; deep groove along the posterior margin of pronotum
- sdn* = subbasal dentation; dentation of pronotum sides
- sdp* = subbasal depression; a pair of distinct foveae
- slb* = sublateral bulges; distinct bulge on sublateral portion of pronotum
- slr* = sublateral longitudinal ridge; articulated carinae arising at antero-lateral portion of clypeus and reaching anterior portion of frons
- smb* = submedian bulges; a pair of distinct bulges on anterior portion of frons
- smlg* = shallow median longitudinal groove; groove of anterior portion of pronotum
- vt* = ventral teeth; a pair of ventral teeth on posterior margin of ventrite 1 and anterior margin of ventrite 2

Repositories

The specimens used in this paper are preserved in the following institutions:

EUMJ = Ehime University Museum, Matsuyama, Japan
HOWP = Hoshizaki Green Foundation, Izumo, Japan
SEHU = Hokkaido University Museum, Sapporo, Japan

Results

Class Insecta Linnaeus, 1758
Order Coleoptera Linnaeus, 1758
Superfamily Hydrophiloidea Latreille, 1802
Family Georissidae Laporte, 1840

Genus *Georissus* Latreille, 1809

Georissus Latreille, 1809: 377. Type species: *Pimelia pygmaea* Fabricius, 1798 (= *Byrrhus crenulatus* Rossi, 1794) [monotypy].

Cathammistes Illiger, 1807a: 297; 1807b: 322 [suppressed, cf. ICZN 1998: 58]. Gender: masculine.

Georyssus [unjustified emendation] – Stephens 1828: 105.

Supplementary description

BODY. Black to reddish brown, oval, strongly convex dorsally.

CLYPEUS. Uneven, with granules or carinae on its surface; articulated carinae arising at antero-lateral portion of clypeus and reaching anterior portion of frons (*slr* in Fig. 1A); a pair of distinct bulges (*smb* in Fig. 1A) on antero-median portion of frons (in *Nipponogeorissus* and *Neogeorissus*); sides of frons smooth, lacking granules (*lsa* in Fig. 1A). Eyes developed, not protuberant. Antennae (Fig. 4M–O) short, 9-segmented, with 3-segmented pubescent club (7-segmented with one-segmented club in Australian species: Fikáček 2019). Mandibles (Fig. 4J–L) large and well sclerotized, partly concealed beneath clypeus and labrum; antero-lateral margin forming obtuse angle; apex pointed; internal margin with microtrichia except apex. Maxillary palpi (Fig. 4A–C) 4-segmented; palpomere 4 longest and nearly same length as palpomeres 1–3 combined. Labrum (Fig. 4D–F) semicircular, widest at base; lateral margins fringed with spines. Mentum subtriangular, strongly narrowed anteriorly, with long setae on disc. Labial palpi (Fig. 4G–I) as long as mentum; apical palpomere oval to oblong oval, densely bearing spines in interior margin.

PRONOTUM. Half oval to trapezoidal, divided into anterior and posterior portions; anterior portion irregularly arranged with granules or short grooves and pits, with shallow median longitudinal groove (*smlg* in Fig. 1B); posterior portion more convex than anterior portion, with large fovea on antero-median portion (*cd* in Fig. 1B); posterior sides of *cd* with a pair of distinct foveae (*sdp* in Fig. 1B) (only in *Neogeorissus*); sublateral portion of posterior portion with distinct bulge (*slb* in Fig. 1B); behind of *slb* with deep groove (*pg* in Fig. 1B); sides somewhat protruding laterally, having dentation (*sdn* in Fig. 1B) in *Neogeorissus*.

LEGS. Protrochantins concealed. Procoxae large, plate-like, concealing prosternum. Femora somewhat flattened. Tibiae slender, especially protibiae rather flattened. Tarsal formula 5-5-5 (5-4-4 in Australian species: Fikáček 2019).

ELYTRA. Provided with ten punctate rows. All or alternate intervals slightly to highly raised. Hind wings well developed or absent in some species.

VENTRITES. Ventriles 1 and 2 connate; ventrite 1 large, with distinct granules; posterior margin of ventrite 1 and anterior margin of ventrite 2 with a pair of ventral teeth (*vt* in Fig. 8A).

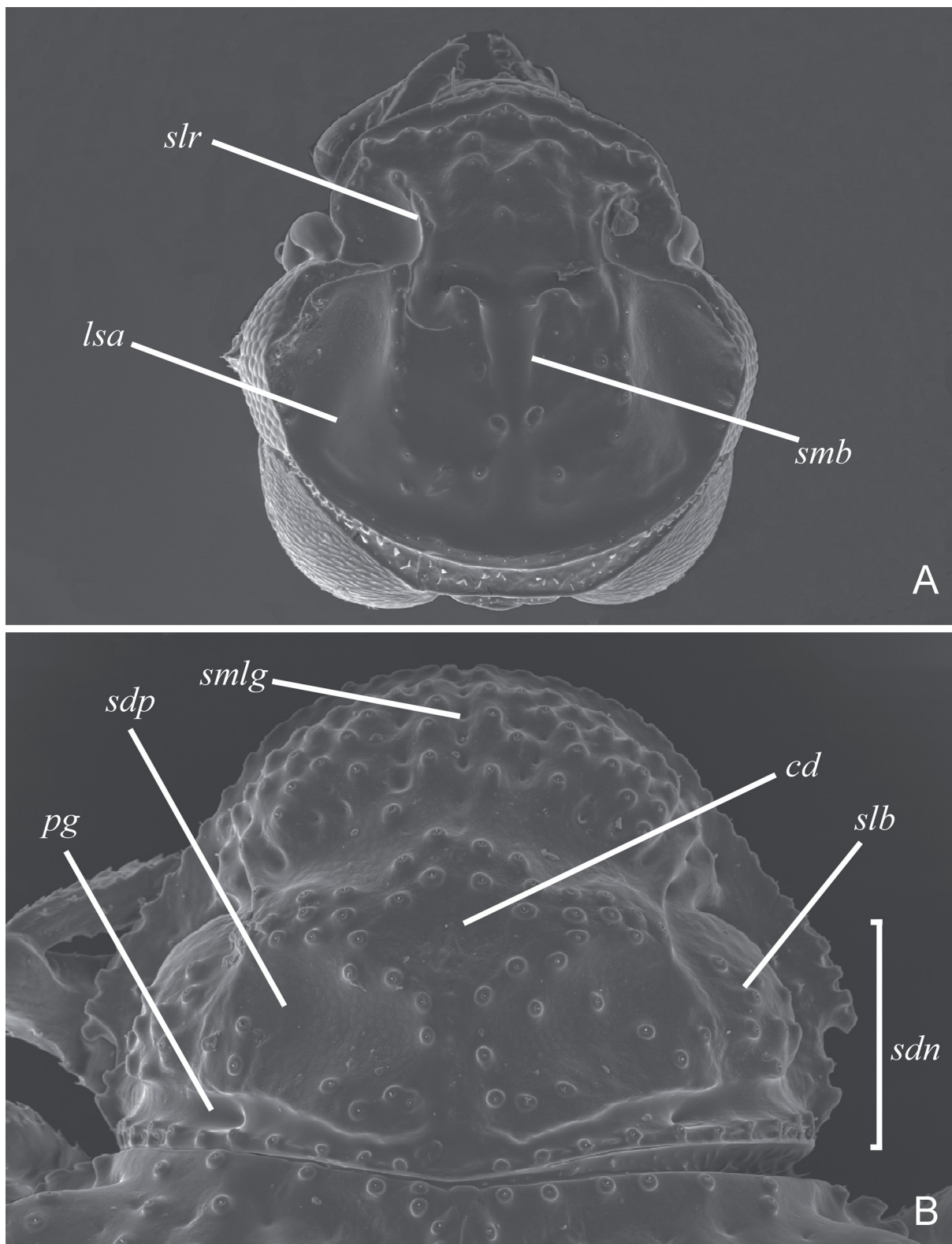


Fig. 1. *Georissus (Ne.) kurosawai* Nakane, 1963, showing terminology. **A.** Head. **B.** Pronotum. Abbreviations: *cd* = central depression; *lsa* = lateral smooth area; *pg* = posterior grooves; *sdn* = subbasal dentation; *sdp* = subbasal depression; *slb* = sublateral bulge; *slr* = sublateral ridge; *smb* = submedian bulge; *smlg* = shallow median longitudinal groove.

MALE GENITALIA (Fig. 9). Aedeagus trilobate type, almost symmetrical.

FEMALE GENITALIA. Gonocoxite (Fig. 10) long, almost cross each other posteriorly. Gonostylus short, provided with two long setae at apex. Median sclerite unilobed, densely bearing long setae. Spermatheca (Fig. 11E–H) slightly sclerotized, elongated oval. Bursal sclerite (Fig. 11A–D) somewhat developed in subgenus *Neogeorissus*, slightly asymmetrical.

Key to the species of the genus *Georissus* from Japan

1. Posterior portion of pronotum with a shallow median longitudinal groove, lacking granules or *cd* and *sdp*. Elytra bearing seriate large punctures. Elytral interstices smooth. Aedeagus broad, median lobe short (Fig. 9A–B). Subgenus *Georissus* Latreille, 1809 2
 - Posterior portion of pronotum provided with granules or foveae. Elytra bearing distinct granules. Elytral interstices raised. Aedeagus narrow, median lobe short or long (Fig. 9C–H) 3
2. Granules of clypeus distinct, large and dense (Fig. 6B). Posterior portion of pronotum lacking a longitudinal groove (Fig. 7B). Internal margins of parameres covered with long setae (Fig. 9B) ***G. (G.) babai*** Satô, 1970
 - Granules of clypeus indistinct, small and sparse (Fig. 6A). Posterior portion of pronotum having a shallow longitudinal groove (Fig. 7A). Internal margins of parameres covered with short setae (Fig. 9A) ***G. (G.) canalifer*** Sharp, 1888
3. Posterior portion of pronotum densely bearing granules, lacking *cd* and *sdp*. Pronotum lacking *sdn* (Fig. 7C). Aedeagus extremely narrow, phallobase posteriorly widening (Fig. 9C). Subgenus *Nipponogeorissus* Satô, 1972 ***G. (Ni.) granulatus*** Satô, 1972
 - Posterior portion of pronotum provided with granules, present *cd* and *sdp*. Pronotum having *sdn* (Fig. 1B). Aedeagus narrow, phallobase subparallel-sided (Fig. 9D–H). Subgenus *Neogeorissus* Satô, 1972 4
4. Elytral interstices 2, 4, 6 highly raised (Fig. 5G–H) ***G. (Ne.) takahashii*** sp. nov.
 - All elytral interstices equally raised (Fig. 5D–F, I) 5
5. Coloration of body black. Elytral granules indistinct (Fig. 5E–F) ***G. (Ne.) kurosawai*** Nakane, 1963
 - Coloration of body dark reddish brown. Elytral granules distinct (Fig. 5D, I) 6
6. Coloration of body black to dark brown. Granulation of pronotum distinct (Fig. 7D). Median lobe shorter than parameres (Fig. 9D) ***G. (Ne.) japonicus*** Satô, 1972
 - Coloration of dark reddish brown. Granulation of pronotum indistinct (Fig. 7I). Median lobe longer than parameres (Fig. 9H) ***G. (Ne.) satoi*** sp. nov.

Subgenus ***Georissus*** Latreille, 1809

Georissus Latreille, 1809: 377. Type species: *Pimelia pygmaea* Fabricius, 1798 (= *Byrrhus crenulatus* Rossi, 1794) [by monotypy].

Georyssus [unjustified emendation] – Stephens 1828: 105.

Redescription

HEAD. Clypeus uneven, with groove along the anterior margin. Surface of clypeus provided with large granules densely; *slr* reaching to anterior margin of frons. Frons bearing median longitudinal groove to vertex; *lsa* narrow, not connecting each other. Granulation of frons sparse, indistinct. Mandibles

(Fig. 4J) relatively small; median lateral margin curving strongly, apex bidentate, mola well developed. Antennae (Fig. 4M) relatively long; antennomere 4 as wide as antennomere 3, about twice as long as antennomere 3; pubescence of club short. Labrum (Fig. 4D) not protruding anteriorly; spines on anterior margin indistinct. Apical labial palpomere (Fig. 4G) oblong oval, with long spines densely. Galea (Fig. 4A) bearing long dense setae.

PRONOTUM. Half oval, slightly projecting laterally in lateral portion, without *sdn*. Lateral margin except anterior portion regularly provided with granules. First half of pronotal disc irregularly bearing foveae and grooves, the second half of disc smooth, but with median longitudinal groove reaching near posterior margin.

ELYTRA. Bearing seriate large punctures. Elytral interstices smooth, not highly raised. Humeral bulges distinct, smooth. Lateral ridges on each elytron indistinct.

ABDOMEN. Ventrites sparsely bearing granules. Ventrites 1–2 provided with a pair of ventral teeth.

MALE GENITALIA. Aedeagus wide, subparallel-sided. Parameres densely provided with small spines on antero-internal portion, as long as phallobase. Median lobe little shorter than parameres. Basal struts short. Phallobase wide; basal foramen large, but indistinct.

FEMALE GENITALIA. Ovipositor relatively elongate to longitudinal portion. Two long setae of gonostylus long.

Remarks

This subgenus is distinguished by the following characteristics: lacking *sdn* (present in *Neogeorissus*); posterior portion of pronotal disc smooth, with median longitudinal groove (uneven, with granules or depression in other subgenera); elytral interstices smooth, not highly elevated (in contrast to uneven, granulated in other subgenera); parameres provided with small dense spines on the anterior portion (even in other subgenera).

The members of this subgenus are often covered with sand or mud when they are alive (Bameul 1989; Shepard 2003; Litovkin 2018; Fikáček 2019). Bameul (1989) reported that adults of *G. crenulatus* attach sand grains to their body surface using oral secretions and their legs.

Georissus (Georissus) canalifer Sharp, 1888

[Japanese name: Marudoromushi]

Figs 2A, 4A, D, G, J, M, 5A, 6A, 7A, 8A, 9A, 10A, 12A; Table 1

Georyssus canalifer Sharp, 1888: 244.

Georyssus canalifer – Miwa 1937: 163.

Georissus (Georissus) canalifer – Satô 1972: 209; 1981: 3; 1985: 205. — Hansen 1999: 50.

Diagnosis

This species resembles palearctic species *G. crenulatus*, and is distinguished from the latter by the presence of shallow longitudinal groove on posterior portion of pronotum (lacking in *G. crenulatus*).

Material examined

JAPAN – **Hokkaido** • 10 ex.; Atsuma-cho, Yufutsu; 12 Jun. 1995; S. Hori leg.; EUMJ • 9 ex.; Kamikawagun, Shintoku-cho, Tomuraushi; 7 Jul. 2006; M. Hanatsuka and Y. Hirano leg.; EUMJ • 12 ex.; Rumoi-shi, Togeshita; 4 Jun. 2004; H. Yoshitomi leg.; EUMJ • 10 ex.; Hamanaka-cho, Esashito; 1 Aug. 2004;

K. Takahashi leg.; EUMJ • 2 ex.; Hamanaka-cho, Biwase; 18 Jun. 1995; I. Matoba leg.; EUMJ • 2 ex.; Kaminokuni-cho, Yunotani; 26 Jun. 1994; S. Hori leg.; EUMJ • 5 ex.; Kamikawa, Ishikari-gawa; 14 Jun. 1986; H. Matsumoto leg.; EUMJ • 2 ex.; Tokachi, Ashoro; 24–31 Jul. 1959; K. Morimoto leg.; EUMJ • 2 ex.; Sapporo-shi, Jozankei; 27 Jul. 2002; H. Yoshitomi leg.; EUMJ • 1 ex.; Akan-cho, Shunkushitakara-gawa; 16 Jun. 1995; I. Matoba leg.; EUMJ • 1 ex.; Toyokoro-cho, Toyokita-kaigan; 23 Jul. 1993; S. Hori leg.; EUMJ • 1 ex.; Taiki-cho, Rekifune-kawa; 23 Jul. 1993; S. Hori leg.; EUMJ.

Redescription

COLORATION (Fig. 2A). Black, weakly shining.

HEAD (Fig. 6A). Clypeus uneven, provided with large granules on anterior portion; *slr* consisted of carinae and granules, granulation of anterior portion distinct, in contrast to posterior portion indistinct. Frons provided with scattered granules. Longitudinal groove distinct, wide, and surrounded by granules; *lsa* narrow, linear.

PRONOTUM (Fig. 7A). Relatively small, widest at posterior $\frac{1}{3}$; anterior portion sparsely provided with short grooves and small foveae; anterior margin smooth; *smlg* deep, with short longitudinal grooves; posterior portion with small granules and shallow longitudinal grooves; lateral margin except anterior portion regularly bearing granules; *slb* indistinct, densely covered with large granules; *pg* short, subobsolete.

ELYTRA (Fig. 5A). Humeral bulges distinct. All intervals slightly elevated and provided regularly with punctures. Lateral ridges indistinct, but with row of small granules. Hind wings well developed.

ABDOMEN (Fig. 8A). Lateral margin of ventrites gradually narrowing posteriorly, especially ventrites 1–2 strongly narrowing. Granules of ventrite 1 large, relatively dense; *vt* large. Granulation of ventrites 2–4 indistinct, 5 distinct and dense.

MALE GENITALIA (Fig. 9A). Aedeagus 0.40 mm long. Parameres slightly shorter than phallobase; basal portions combined as wide as anterior portion of phallobase; lateral margins slightly bulbous at anterior portion; internal margins asymmetrical; anterior portion with short setae densely. Median lobe shorter than parameres, gradually narrowing apically; basal struts short. Phallobase about 1.8 times as long as wide, widening posteriorly; posterior portion with large basal foramen.

FEMALE GENITALIA (Fig. 10A). Latero-tergites 8 forming acute angle; apex strongly incurved. Spines of gonostylus long.

Biological notes

This species is common in Hokkaido and inhabits wet sandy river beds in summer (Sharp 1888; Miwa 1937).

Distribution

Japan: Hokkaido (Fig. 13); Russia: Sakhalin, Kunashir (Ryndevich *et al.* 2021).

Georissus (Georissus) babai Satô, 1970

[Japanese name: Baba-marudoromushi]

Figs 2B, 3A, G, 5B, 6B, 7B, 8B, 9B, 10B; Table 1

Georyssus babai Satô, 1970: 199.

Georissus (Georissus) babai – Satô 1972: 209; 1981: 3; 1985: 205. — Hansen 1999: 50.

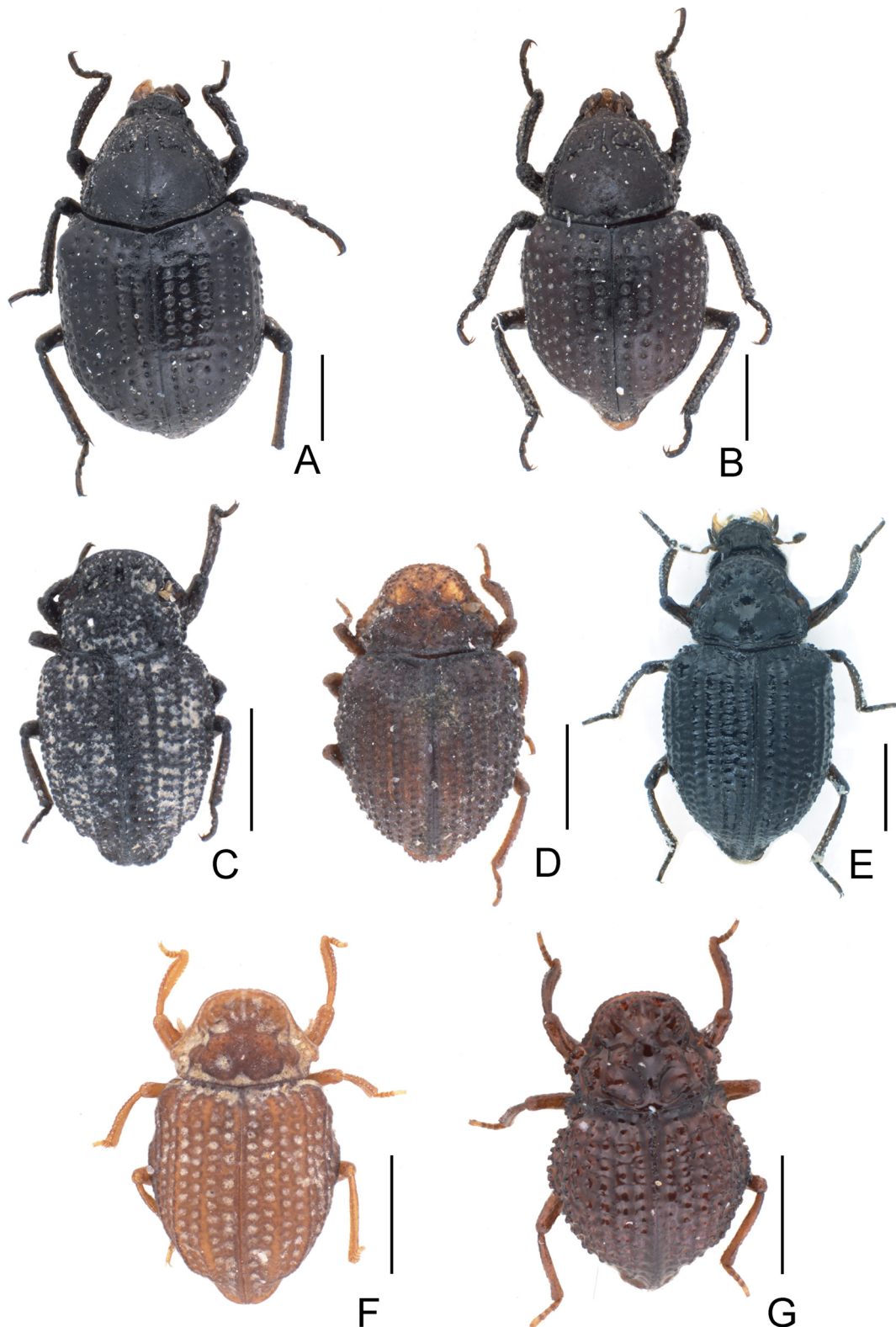


Fig. 2. Dorsal view of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ni.) granulosus* Satô, 1972. **D.** *G. (Ne.) japonicus* Satô, 1972. **E.** *G. (Ne.) kurosawai* Nakane, 1963. **F.** *G. (Ne.) takahashii* sp. nov., holotype, ♂ (EUMJ). **G.** *G. (Ne.) satoi* sp. nov., holotype (EUMJ). Scale bars = 0.5 mm.

Diagnosis

This species resembles the palearctic species *G. crenulatus*, and is distinguished from the latter by the granulation of the frons: *G. babai* has large granules on the median and lateral portions whereas *G. crenulatus* only on the median portion.

Material examined

Holotype

JAPAN – Honshu: Niigata Pref. • ♂; Echigo, Sasaguchi-hama; 26 Apr. 1959; K. Baba leg.; EUMJ (Fig. 3A, K).

Paratypes

JAPAN – Honshu: Niigata Pref. • 2 ex.; same collection data as for holotype; EUMJ • 2 ex.; N-Echigo, Nakajo; 3 May 1959; K. Baba leg.; EUMJ.

Other material

JAPAN – Honshu: Niigata Pref. • 16 ex.; Sasaguchi-hama; 10 May. 1961; K. Baba leg.; EUMJ • 1 ex.; Sasaguchi-hama; 26 Apr. 1959; K. Baba leg.; EUMJ.

Redescription

COLORATION (Fig. 2B). Black to dark reddish brown, weakly shining.

HEAD (Fig. 6B). Clypeus uneven, provided with bearing large granules on anterior portion extensively; *slr* consisted of large granules. Frons provided with large granules along the anterior to lateral margin; longitudinal groove distinct and narrow, surrounded granules only anterior portion; *lsa* relatively wide, slightly curving inside.

PRONOTUM (Fig. 7B). Relatively large, widest at the posterior third. Anterior portion provided with short grooves and small deep foveae; anterior margin slightly crenelated; *smlg* shallow, with short longitudinal grooves. Posterior portion smooth, lacking granules; longitudinal groove indistinct. Lateral margin except anterior portion regularly bearing granules; *slb* indistinct, sparsely with large granules; *pg* relatively long and narrow.

ELYTRA. Widest at the middle, as wide as maximum width of pronotum in basal margin; suture and intervals not elevated, intervals bearing distinct punctures; humeral bulges poorly developed. Lateral ridges indistinct.

ABDOMEN (Fig. 9B). Lateral margin of ventrites gradually narrowing posterior, ventrites 1 and 2 strongly narrowing. Teeth of ventrite 1 large; teeth of ventrite 2 indistinct. Granulation of ventrites 2–5 distinct, large.

MALE GENITALIA (Fig. 9B). Aedeagus 0.42 mm long. Parameres slightly shorter than phallobase, their basal portions combined as wide as anterior portion of phallobase; lateral margins bulbous at apical portion; internal margins subparallel-sided, with long setae densely at apical portion. Median lobe shorter than parameres, subparallel-sided, slightly angular at apex; basal struts relatively long. Phallobase about 2.0 times as long as wide, slightly widening posteriorly; posterior portion with large basal foramen.

FEMALE GENITALIA (Fig. 10B). Latero-tergites 8 forming acute angle; apex strongly incurved. Setae of gonostylus long.

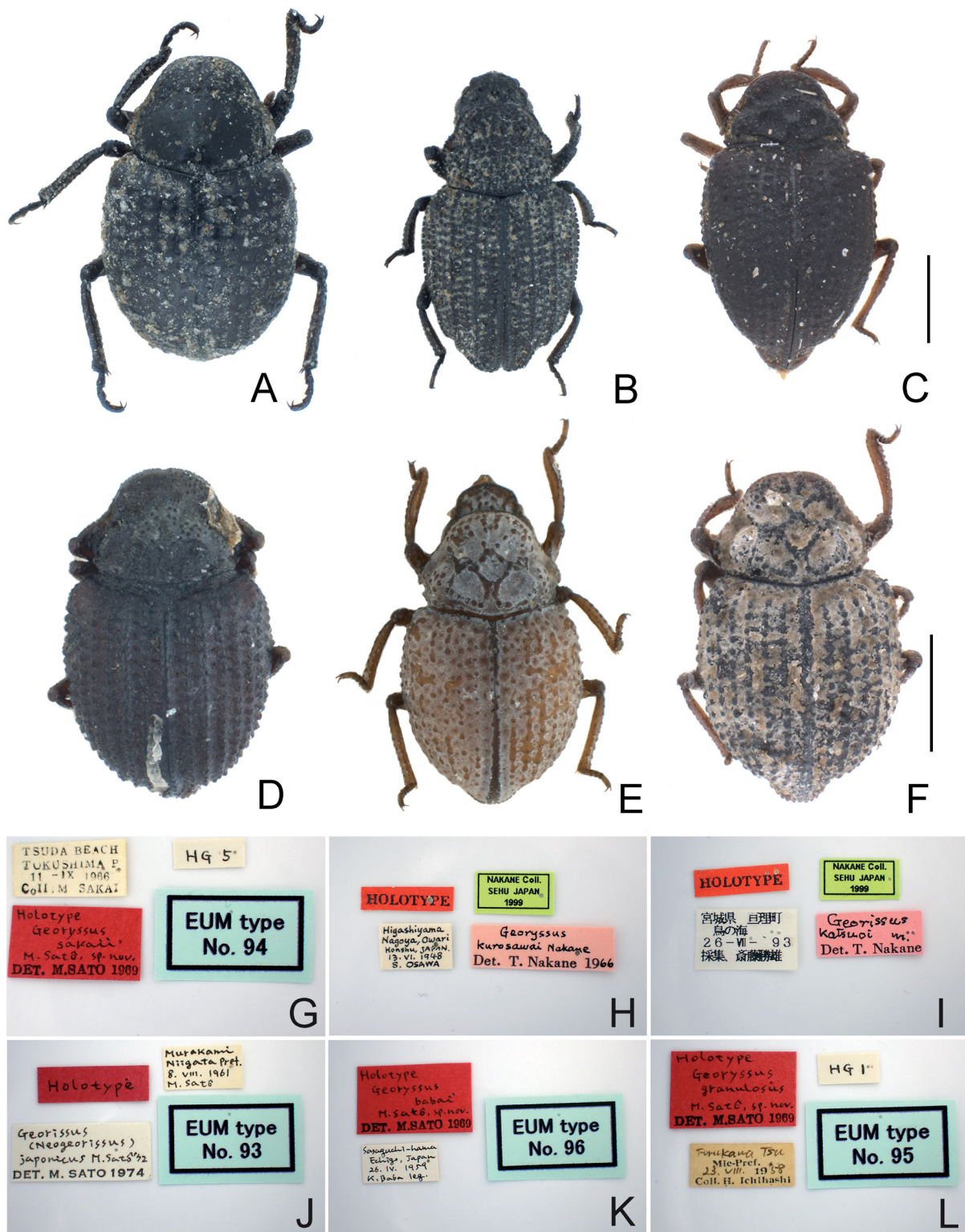


Fig. 3. Holotypes of *Georissus* spp. A–F. Dorsal habitus. G–L. Labels. A, K. *G. (G.) babai* Satô, 1970, ♂ (EUMJ). B, L. *G. (Ni.) granulosus* Satô, 1972, ♀ (EUMJ). C, H. *G. (Ne.) kurosawai* Nakane, 1963, ♂ (SEHU). D, J. *G. (Ne.) japonicus* Satô, 1972, ♂ (EUMJ). E, G. *G. (Ne.) sakaii* Satô, 1972, ♂ (EUMJ). F, I. *G. (Ne.) katsuoi* Nakane, 1995 (SEHU). Scale bars = 0.5 mm.

Biological notes

This species was collected using a pitfall trap at a sandy place with *Imperata cylindrica* (L.) Raeusch. (Poaceae) in Shizuoka Prefecture (Tabira & Ishikawa 2011). But there have been no additional records from Niigata Prefecture, the type locality of this species.

Distribution

Japan: Honshu (Niigata and Shizuoka Prefs) (Fig. 13).

Subgenus *Nipponogeorissus* Satô, 1972

Nipponogeorissus Satô, 1972: 212. Type species: *Georissus granulosus* Satô, 1972 (by original designation).

Redescription

HEAD. Both clypeus and frons uneven, provided extensively with foveae, with distinct carinae; *slr* reaching anterior margin of frons; *lsa* connecting each other, forming U-shape. Granulation of clypeus indistinct. Mandibles (Fig. 4K) relatively large; lateral margin linear, apex unidentate; mola not developed. Antennae (Fig. 4N) relatively short; antennomere 4 as wide as antennomere 3, about twice as long as antennomere 3; pubescence of club short. Labrum (Fig. 4E) protruding anteriorly; spines on anterior margin indistinct. Apical labial palpomere (Fig. 4H) elongated oval, densely bearing short spines. Galea (Fig. 4B) densely bearing short setae.

PRONOTUM. Half oval; lateral portion slightly projecting laterally; disc densely provided with granules; *smlg* distinct; without *sdn*.

ELYTRA. Bearing four longitudinal costae consisting of granules. Humeral bulges distinct. Lateral ridges indistinct.

ABDOMEN. Ventrites densely bearing granules; ventrites 1–2 without *vt* and excavation.

MALE GENITALIA. Aedeagus elongated. Parameres as long as phallobase. Median lobe little shorter than parameres. Basal struts short. Phallobase bulbous at basal portion.

Remarks

This subgenus is distinguished by the combination of the following characters: pronotum provided with large granules extensively (not extensively in subgenera *Georissus* and *Neogeorissus*); disc of clypeus and frons provided with many carinae, granulation indistinct (in other subgenera, granulation distinct). This subgenus comprises only two species from Japan and Papua New Guinea: the Japanese species is *G. (Ni.) granulosus* Satô, 1972, and the other species is *G. (Ni.) biroi* Delève, 1969. *Georissus (Neogeorissus) maritimus* Fikáček *et al.*, 2012 described from Socotra Island (Yemen) is similar to *Nipponogeorissus* species in the entirely granulated pronotum, and narrow, elongated aedeagus (Fikáček *et al.* 2012).

Georissus (Nipponogeorissus) granulosus Satô, 1972

[Japanese name: Sesuji-marudoromushi]

Figs 2C, 3B, H, 4B, E, H–I, N, 5C, 6C, 7C, 8C, 9C; Table 1

Georissus (Nipponogeorissus) granulosus Satô, 1972: 212.

Georissus (Nipponogeorissus) granulosus – Satô 1981: 4; 1985: 205. — Hansen 1999: 49.

Table 1. Measurements of *Georissus* (*G.*) spp. and *G. (Nipponogeorissus) granulosus* Satô, 1972.

	<i>G. (G.) canalifer</i> (N = 53)	<i>G. (G.) babai</i> (N = 20)	<i>G. (Ni.) granulosus</i> (N = 5)
TL (mm)	1.46–2.30 (1.91)	1.34–1.90 (1.91)	1.28–1.54 (1.38)
EL (mm)	0.86–1.62 (1.27)	0.82–1.26 (1.09)	0.86–1.02 (0.92)
EW (mm)	0.90–1.38 (1.17)	0.82–1.16 (1.05)	0.70–0.88 (0.79)
PL (mm)	0.52–0.78 (0.64)	0.52–0.66 (0.60)	0.40–0.52 (0.46)
PW (mm)	0.70–1.04 (0.85)	0.68–0.88 (0.79)	0.52–0.62 (0.58)
PW/PL	1.08–1.66 (1.33)	1.15–1.41 (1.32)	1.15–1.35 (1.26)
EL/EW	0.86–1.23 (1.08)	0.83–1.24 (1.03)	1.05–1.26 (1.16)
EL/PL	1.43–2.48 (1.98)	1.58–2.07 (1.82)	1.87–2.20 (2.00)
EW/PW	1.10–1.56 (1.38)	1.21–1.53 (1.33)	1.28–1.47 (1.37)
TL/EW	1.45–1.84 (1.64)	1.34–1.86 (1.60)	1.57–1.83 (1.74)

Diagnosis

This species is easily distinguished from other Japanese species of *Georissus* by the granulated pronotum and shape of male aedeagus; shape elongated and narrow, phallobase widening. This species is distinguished from *Georissus biroi* described from Papua New Guinea by the carinae of frons; *G. granulosus* has transverse carinae, in contrast to their absence in *G. biroi*.

Material examined

Holotype

JAPAN – Honshu: Mie Pref. • ♀; Tsu-shi, Furukawa; 23 Aug. 1958; H. Ichihashi leg.; EUMJ (Fig. 3B, L).

Other material

JAPAN – Honshu: Mie Pref. • 5 ex.; Ise-shi, Iso-cho, Miya-gawa; 16 Jun. 2008; K. Akita leg.; EUMJ.

Redescription

COLORATION (Fig. 2C). Black, mat, legs dark reddish brown.

HEAD (Fig. 6C). Clypeus uneven, provided with foveae and carinae throughout; *slr*, consisted of granules, connecting to *smb* at median portion; *smb* nonsequential, connecting each other, forming oblong oval; *lsa* connecting each other, forming U-shape.

PRONOTUM (Fig. 7C). Relatively large, widest at the middle. Pronotal disc provided with granules densely. Anterior portion provided with indistinct granules extensively; anterior margin smooth, not crenelated; *smlg* distinct, with longitudinal row of pits. Posterior portion slightly convex than anterior portion, bearing granulation regularly; lateral margins protruding; *slb* developed; *pg* indistinct, short.

ELYTRA. Entirely granulate. Elytral intervals 2, 4, 6 and 8 elevated, forming longitudinal carinae. Humeral bulge distinct, bearing granules. Lateral ridges indistinct. Hind wings developed.

ABDOMEN (Fig. 8C). Lateral margin of ventrites uniformly narrowing posteriorly. Ventrite 1 with large granules extensively. Granulation of ventrites 2–5 large and relatively indistinct.

MALE GENITALIA (Fig. 9C). Aedeagus 0.37 mm long. Parameres slightly shorter than phallobase, basal portions of parameres combined as wide as anterior portion of phallobase; lateral margins. Median lobe shorter than parameres, subparallel-sided, slightly angular at apex; basal struts short. Phallobase about 2.4 times as long as wide, widening posteriorly; posterior portion with large basal foramen.

FEMALE GENITALIA. Not examined.

Biological notes

This species inhabits tidal flats that are submerged at high tide (Akita 2008). The holotype was collected at light (Satô 1981).

Distribution

Japan: Honshu (Mie Pref.) (Fig. 13).

Subgenus *Neogeorissus* Satô, 1972

Neogeorissus Satô, 1972: 209. Type species: *Georissus japonicus* Satô, 1972 (by original designation).

Redescription

HEAD. Clypeus uneven, with a line of low granules along the anterior margin. Surface of clypeus provided with scattered granules; *slr* long, reaching to mid-length of frons. Frons provided with granules and some foveae on median portion; *lsa* distinct, connecting each other, forming U-shape. Mandibles (Fig. 4L) relatively large; median lateral margin curving strongly, apex unidentate or bidentate, mola well developed. Antennae (Fig. 4O) relatively long; antennomere 4 thin, more than twice as long as antennomere 3; pubescence of club long. Labrum (Fig. 4F) not protruding anterior, spines on anterior margin distinct. Apical segment of labial palpi (Fig. 4I) oblong oval, with long spines densely. Galea (Fig. 4C) densely bearing long setae.

PRONOTUM. Half circular, anterior portion slightly projecting to lateral. Median longitudinal groove reaching at the middle of pronotum. First half of pronotal disc bearing foveae and grooves irregularly, the second half of disc with foveae, especially distinct on a central one (*cd*) and two oblique large ones just before the posterior margin (*sdp*). Pronotal sides have dentation at subbasal portion (*sdn*). Posterior margin provided with granules, bearing grooves along the posterior margins.

ELYTRA. Provided with rows of granules. Puncture distinct. Elytral interstices raised and formed distinct carinae in some species. Humeral bulges distinct, with granules. Lateral ridges on each elytron developed, with granules.

ABDOMEN. Ventrites bearing with granules sparsely. Ventrites 1 and 2 lacking *vt* in Japanese species, but in some species having distinct *vt* (e.g., Delève 1967a; Fikáček *et al.* 2012).

MALE GENITALIA. Aedeagus elongate, subparallel-sided. Parameres shorter than phallobase. Median lobe relatively long. Basal struts long. Phallobase subparallel-sided.

FEMALE GENITALIA. Ovipositor relatively elongate to lateral portion. Two long setae of gonostylus long to short. Spermatheca oblong oval, curving inside, slightly sclerotized. Bursal sclerite slightly asymmetrical, slightly to highly sclerotized.

Remarks

This subgenus is distinguished by the combination of the following characters: pronotal side with dentation (without dentation in *Georissus* and *Nipponogeorissus*); posterior portion of pronotum provided with *cd* and *sdp* (without in *Georissus* and *Nipponogeorissus*).

Georissus (Neogeorissus) japonicus Satô, 1972

[Japanese name: Yamato-marudoromushi]

Figs 2D, 3D–F, J–L, 4C, F, I, L, O, 5D, 6D, 7D, 8D, 9D, 10C, 11A, 11E; Table 2

Georissus (Neogeorissus) japonicus Satô, 1972: 210.

Georissus (Neogeorissus) sakaii Satô, 1972: 210. **Syn. nov.**

Georissus (Neogeorissus) katsuoii Nakane, 1995: 42. **Syn. nov.**

Georissus (Neogeorissus) japonicus – Satô 1981: 3; 1985: 206. — Hansen 1999: 47.

Georissus (Neogeorissus) sakaii – Satô 1981: 3; 1985: 206. — Hansen 1999: 49.

Georissus (Neogeorissus) katsuoii – Hansen 1999: 47.

Diagnosis

This species is distinguished from other Japanese *Neogeorissus* species by the combination of following characteristics; distinct granulation of pronotum and elytra; median lobe shorter than paramere (in contrast to median lobe longer than paramere in other Japanese species of *Neogeorissus*).

Material examined

Holotype of *G. (Ne.) japonicus* Satô, 1972

JAPAN – Honshu: Niigata Pref. • ♂; Murakami; 8 Aug. 1961; M. Satô leg.; EUMJ (Fig. 3D, J).

Holotype of *G. (Ne.) sakaii* Satô, 1972

JAPAN – Shikoku: Tokushima Pref. • ♂; Tsuda Beach; 11 Sep. 1966; M. Sakai leg.; EUMJ (Fig. 3E, G).

Holotype of *G. (Ne.) katsuoii* Nakane, 1995

JAPAN – Honshu: Miyagi Pref. • sex unknown; Water-machi, Torinoumi; 26 Aug. 1993; K. Saito leg.; SEHU (Fig. 3F, I).

Other material

JAPAN – Honshu: Niigata Pref. • 4 ex.; Murakami; 8 Aug. 1961; M. Satô leg.; EUMJ. – Honshu: Shizuoka Pref. • 1 ex.; Hamamatsu, Ishiyama; 25 May 2001; K. Hirai leg.; EUMJ • 1 ex.; Hamamatsu, Enshuhama; 4 Oct. 2001; K. Hirai leg.; EUMJ • 3 ex.; Hamamatsu, Enshuhama; 13 Oct. 2001; K. Hirai leg.; EUMJ • 6 ex.; Hamamatsu-shi, Matsushima-cho, Enshuhama; 13 Oct. 2002; K. Hirai leg.; EUMJ. – Kyushu: Fukuoka Pref. • 8 ex.; Kouge-machi, Shimotoubaru; 23 Jul. 2013; M. Mori leg.; EUMJ.

Redescription

COLORATION (Fig. 2D). Black to dark brown, matt. Body surface often covered with grayish substance.

HEAD (Fig. 6D). Clypeus uneven, provided with large granules sparsely; *slr* consisted of granules, reaching to posterior third of frons, posteriorly connected to *smb* by an arc of sparsely arranged granules and formed a pair of half-rounded foveae; *smb* consisted of tubercles and granules, anterior portion projecting to laterally; *lsa* with a shallow groove along the posterior margin.

PRONOTUM (Fig. 7D). Relatively large, widest at the middle. Anterior portion provided with granules densely; *smlg* relatively wide, granulation dense, with longitudinal row of sparse pits. Posterior portion

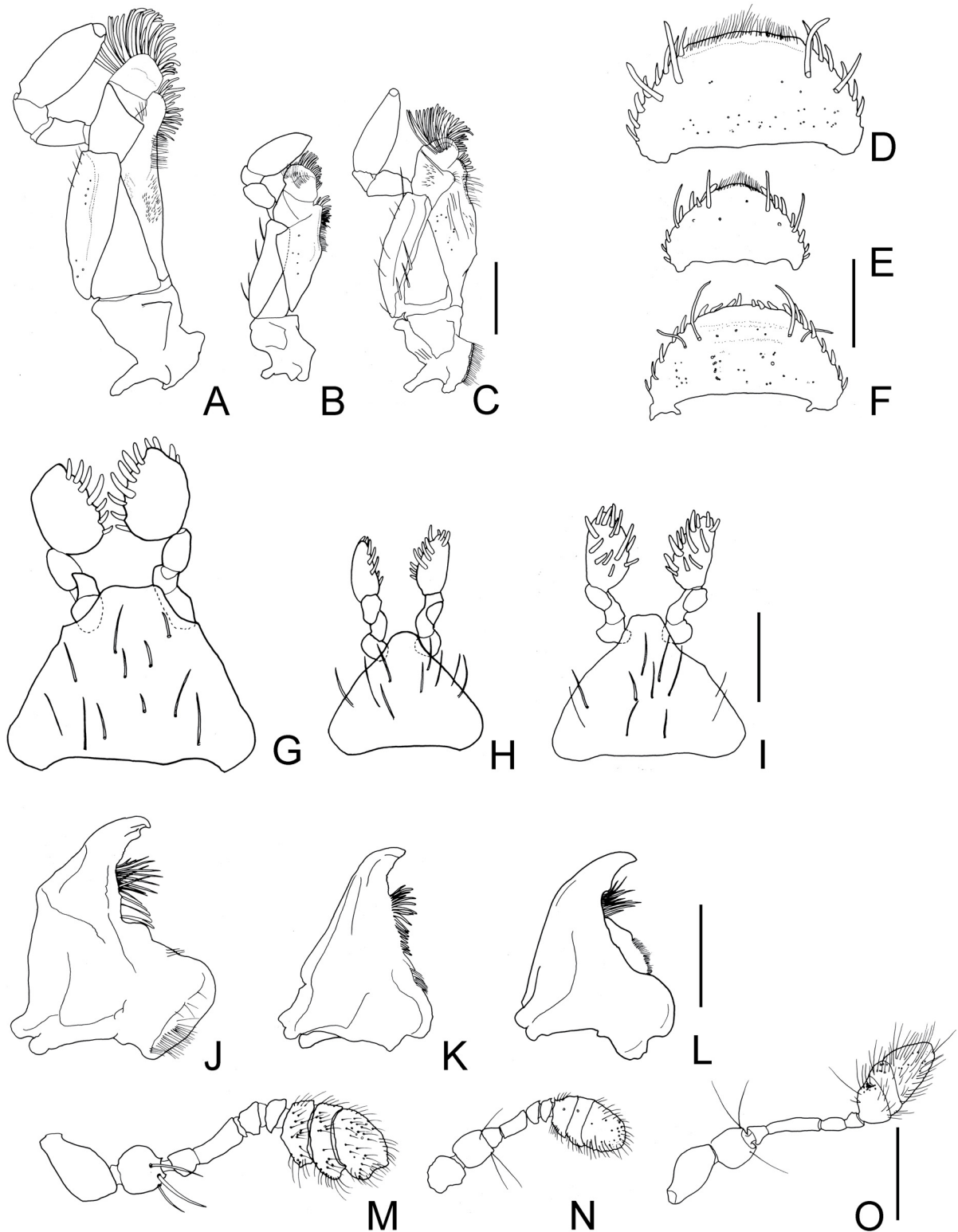


Fig. 4. Mouth parts and antennae of *Georissus* spp. A–C. Left maxillae. D–F. Labrum. G–I. Labial palpi. J–L. Left mandibles. M–O. Left antennae. A, D, G, J, M. *G. (G.) canalifer* Sharp, 1888. B, E, H, K, N. *G. (Ni.) granulosus* Satô, 1972. C, F, I, L, O. *G. (Ne.) japonicus* Satô, 1972. Scale bars = 0.1 mm.

somewhat convex than anterior portion; *cd* rhomboid, surrounded by granules; *sdp* oblong oval, larger than *cd*, surrounded by granules; *slb* developed, with distinct granules; *pg* short and narrow, not reaching median portion of *sdp*; *sdn* developed, having a few teeth.

ELYTRA. Humeral bulges distinct. All intervals slightly elevated, provided with distinct rows of granules. Elytral punctures distinct. Lateral ridges on each elytron highly elevated, bearing distinct granules. Hind wings fully developed.

ABDOMEN (Fig. 8D). Lateral margin of ventrites uniformly narrowing posterior. Granules of ventrite 1 large and dense. Granulation of ventrites 2–4 indistinct, ventrite 5 distinct and sparse.

MALE GENITALIA (Fig. 9D). Aedeagus 0.30 mm long. Parameres shorter than phallobase, their basal portions combined as wide as anterior portion of phallobase; lateral margins bulbous at median portion; internal margins straight. Median lobe shorter than parameres, subparallel-sided, slightly angular at apex; basal struts short. Phallobase about 2.5 times as long as wide, sides parallel: posterior portion with large basal foramen.

FEMALE GENITALIA. Latero-tergites 8 forming acute angle (Fig. 10C); apex strongly incurved. Setae of gonostylus short. Spermatheca (Fig. 11E) curved oval, narrowing at apical portion. Bursal sclerite (Fig. 11A) large and asymmetrical, feebly sclerotized.

Remarks

Satô (1972) mentioned that *Georissus* (*Neogeorissus*) *sakaii* was closely related to *G. japonicus* and distinguished by granules and foveae on body surface. Subsequently, Nakane (1995) described *Georissus* (*Neogeorissus*) *katsuoii* as a new species without comparison with the related species *G. sakaii* and *G. japonicus*. Both species were described based on only holotypes, and there have been no additional records until now. After a detailed comparison of holotype and additional specimens of the above three species, we conclude that they are the same species.

Biological notes

This species was collected from coastal sandy beaches (Shizuoka, Tokushima), a river bank (Iwata & Iwata 2012, in Saitama by pit fall trap), or the shores of ponds (Niigata, Fukuoka).

Distribution

Russian Federation (Lafer 1989); Japan: Honshu (Miyagi, Ibaraki, Niigata, Shizuoka Prefs), Shikoku (Tokushima Pref.), Kyushu (Fukuoka Pref.) (Fig. 13).

Georissus (*Neogeorissus*) *kurosawai* Nakane, 1963

[Japanese name: Shiwamune-marudoromushi]

Figs 1, 2E, 3C, I, 5E–F, 6E–F, 7E–F, 8E–F, 9E, 10D, 11B, F, 12C; Table 2

Georyssus kurosawai Nakane, 1963: 63.

Georyssus kurosawai – Nakane 1966: 58.

Georissus (*Neogeorissus*) *kurosawai* – Satô 1972: 211; 1981: 3; 1985: 206. — Hansen 1999: 47.

Georyssus laesicollis Germar, 1831 – Kurosawa 1950: 1107 [misidentification].

Diagnosis

This species is similar to the European species, *G. laesicollis* Germar, 1831, and is distinguished by the oblong oval body shape (more rounded body shape in *G. laesicollis*) and length of median lobe: *G. kurosawai* longer than paramere, in contrast to shorter than paramere in *G. laesicollis* (see Fikáček 2012).

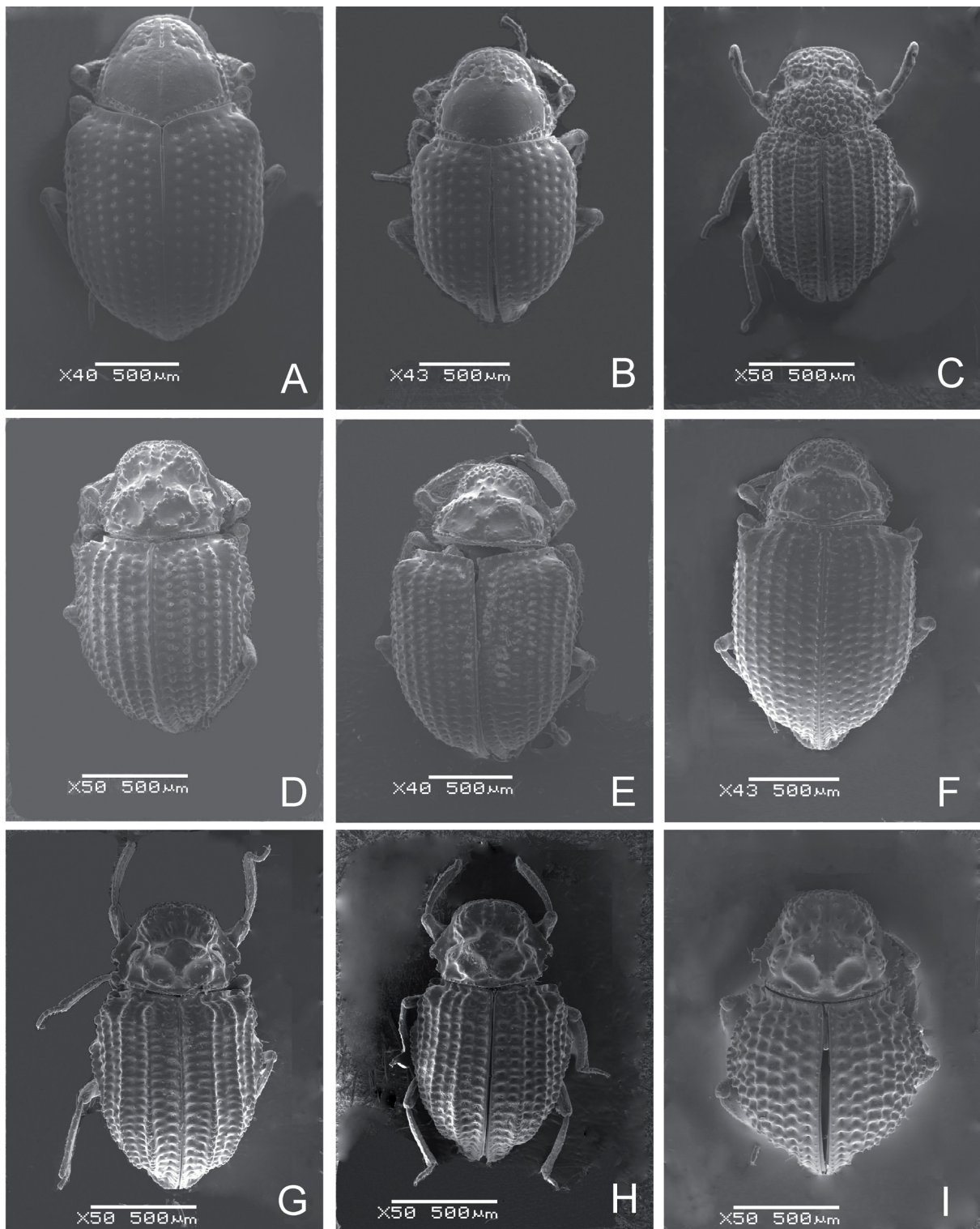


Fig. 5. Dorsal habitus of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ni.) granulosus* Satô, 1972. **D.** *G. (Ne.) japonicus* Satô, 1972. **E–F.** *G. (Ne.) kurosawai* Nakane, 1963 from Hokkaido (E) and Nagano (F). **G–H.** *G. (Ne.) takahashii* sp. nov. from Kochi (G) and Okinawa (H). **I.** *G. (Ne.) satoi* sp. nov.

Material examined

Holotype

JAPAN – **Honshu: Aichi Pref.** • ♂; Owari, Nagoya, Higashiyama; 13 Jun. 1948; S. Osawa leg.; SEHU (Fig. 3C, H).

Other material

JAPAN – **Hokkaido** • 4 ex.; Otohuke-cho, Shihoro-gawa; 1–3 Aug. 2003; H. Yoshitomi leg.; EUMJ • 25 ex.; Okushiri Isl., Tsurikakegawa; 2 Aug. 2005; S. Horii leg.; EUMJ • 1 ex.; Okushiri Is., Tsurikakegawa, Yachi Riv.; 6–9 Jun. 2003; S. Horii leg.; pitfall trap; EUMJ. – **Honshu: Miyagi Pref.** • 1 ex.; Yakurai-onsen; 21 Aug. 1998; M. Satō leg.; EUMJ. – **Honshu: Tochigi Pref.** • 2 ex.; Ootawara-shi, Sabigawa; 25 Jul. 1994; H. Yoshitomi leg.; EUMJ. – **Honshu: Chiba Pref.** • 2 ex.; Futtsu-shi; 19 May 1998; H. Hamaji leg.; EUMJ • 1 ex.; Kimitsu-shi, Takihara; 29 Jul. 2002; H. Ono leg.; EUMJ. – **Honshu: Tokyo Pref.** • 1 ex.; Nakagawara; 26 Aug. 1941; I. Fujiyama leg.; EUMJ. – **Honshu: Yamanashi Pref.** • 15 ex.; Tsukiyono, Doushi; 16 Aug. 1986; Y. Hirano leg.; EUMJ. – **Honshu: Nagano Pref.** • 8 ex.; Ina-shi, Todai-gawa; 28 Aug. 2009; T. Yoshida leg.; EUMJ. – **Honshu: Gifu Pref.** • 17 ex.; Tokuyama-mura, near Shiratani; ca 450 m alt.; 7 Jul. 1988; M. Hasegawa leg.; EUMJ. – **Honshu: Aichi Pref.** • 3 ex.; Toyota, Yahagi-gawa; 8 Aug. 2001; Y. Utsunomiya leg.; EUMJ. – **Honshu: Mie Pref.** • 4 ex.; Yokkaichi; 27 Jul. 1984; A. Amagasu leg.; EUMJ • 1 ex.; Yokkaichi; 20 Jun. 1985; H. Ichihashi leg.; EUMJ • 4 ex.; Suzuka-shi, Ifuna-cho, Onbe-gawa; 3 Jul. 2004; N. Narukawa leg.; EUMJ • 19 ex.; Asake-gawa, Yokkaichi; 11 Jun. 1988; A. Amagasu leg.; EUMJ. – **Honshu: Wakayama Pref.** • 1 ex.; Honguu-cho; 29 Sep. 2007; K. Takahashi leg.; EUMJ. – **Honshu: Kyoto Pref.** • 1 ex.; Katsura-gawa, Yose; 25 Apr. 1941; M. Kubota leg.; EUMJ. – **Shikoku: Ehime Pref.** • 1 ex.; Shuso-gun, Tanbara-cho, Yanadani; 15 Jul. 2003; Y. Kashitani leg.; EUMJ • 3 ex.; Toon-shi, Yamanouchi, Shigenobu-gawa; 1 Nov. 2020; K. Yasuda leg.; EUMJ • 9 ex.; same collection data as for preceding; 3 Nov. 2020; EUMJ • 7 ex.; same collection data as for preceding; 9 Dec. 2020; EUMJ • 5 ex.; same collection data as for preceding; 20 Dec. 2020; EUMJ • 6 ex.; same collection data as for preceding; 31 Dec. 2020; EUMJ.

Redescription

COLORATION (Fig. 2E). Black, weakly shining, legs dark reddish brown. Body surface often covered with greyish substance.

HEAD (Fig. 6E). Clypeus relatively smooth, provided with a few large granules on median portion; *slr* consisted of carinae and indistinct granules, reaching to mid-length of frons, posteriorly connected to *smb* by an arc of sparsely arranged large granules and formed a pair of half-rounded foveae; *smb* V-shaped and not connected each other, with indistinct granules; *lsa* with a few small granules at lateral portion.

PRONOTUM (Fig. 7E). Relatively small, widest at the middle. Anterior portion provided with granules and pits densely; anterior margin crenellated; *smlg* shallow and narrow, with distinct longitudinal row of pits. Posterior portion somewhat convex than anterior portion; *cd* circular and relatively small, surrounded by many granules; *sdp* oblong oval to rectangle, larger than *cd*, with some granules; *slb* well developed, provided with distinct granules at posterior portion; *pg* short and narrow, not reaching median portion of *sdp*; *sdn* poorly developed, provided with a few teeth.

ELYTRA. Widest at middle, slightly wider than pronotum in basal margin; suture and intervals slightly elevate, regularly bearing indistinct granules; punctures distinct and regular. Humeral bulge distinct, bearing with granules. Lateral ridges on each elytron weakly developed. Hind wings fully developed.

ABDOMEN (Fig. 8E). Lateral margin of ventrites gradually narrowing posterior, especially ventrites 1 and 2 strongly narrowing. All ventrites bearing sparse scattered granules.

MALE GENITALIA (Fig. 9E). Aedeagus 0.43 mm long. Parameres shorter than phallobase, their basal portions combined as wide as anterior portion of phallobase; lateral margins slightly articulated: internal margins slightly widening. Median lobe longer than parameres, the sides almost paralleled, but slightly bulbous at base; slightly angular at apex; basal struts long. Phallobase about 2.2 times as long as wide, sides paralleled: posterior portion with large basal foramen.

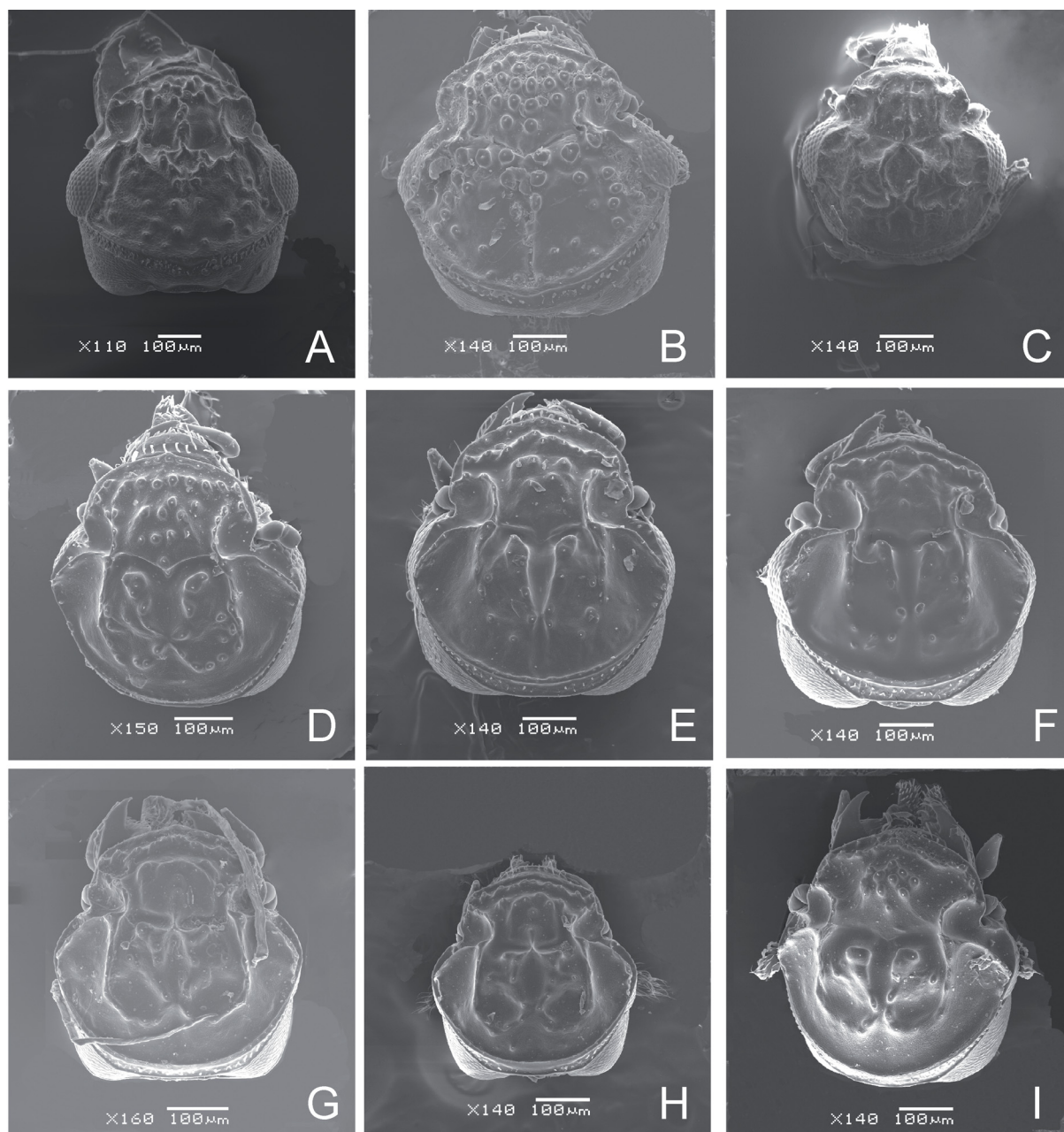


Fig. 6. Head of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ni.) granulatus* Satô, 1972. **D.** *G. (Ne.) japonicus* Satô, 1972. **E–F.** *G. (Ne.) kurosawai* Nakane, 1963 from Hokkaido (E) and Nagano (F). **G–H.** *G. (Ne.) takahashii* sp. nov. from Kochi (G) and Okinawa (H). **I.** *G. (Ne.) satoi* sp. nov.

FEMALE GENITALIA. Latero-tergites 8 (Fig. 10D) forming obtuse angle; apex slightly or not incurved. Setae of gonostylus short. Spermatheca (Fig. 11F) elongated oval, relatively bulbous at apical portion. Bursal sclerite (Fig. 11B) slightly asymmetrical, well sclerotized.

Biological notes

This is a common species collected in all seasons. It inhabits wet sandy river beds and is often observed under rocks (Fig. 12B). This species was also collected using pitfall traps or light traps (Arai 2006; Iwata & Iwata 2012).

Distribution

Japan: Hokkaido, Honshu (Miyagi, Fukushima, Tochigi, Saitama, Chiba, Tokyo, Yamanashi, Shizuoka (Tabira 2005) Gifu, Aichi, Mie, Wakayama, Kyoto Prefs), Shikoku (Ehime Pref.) (Fig. 13).

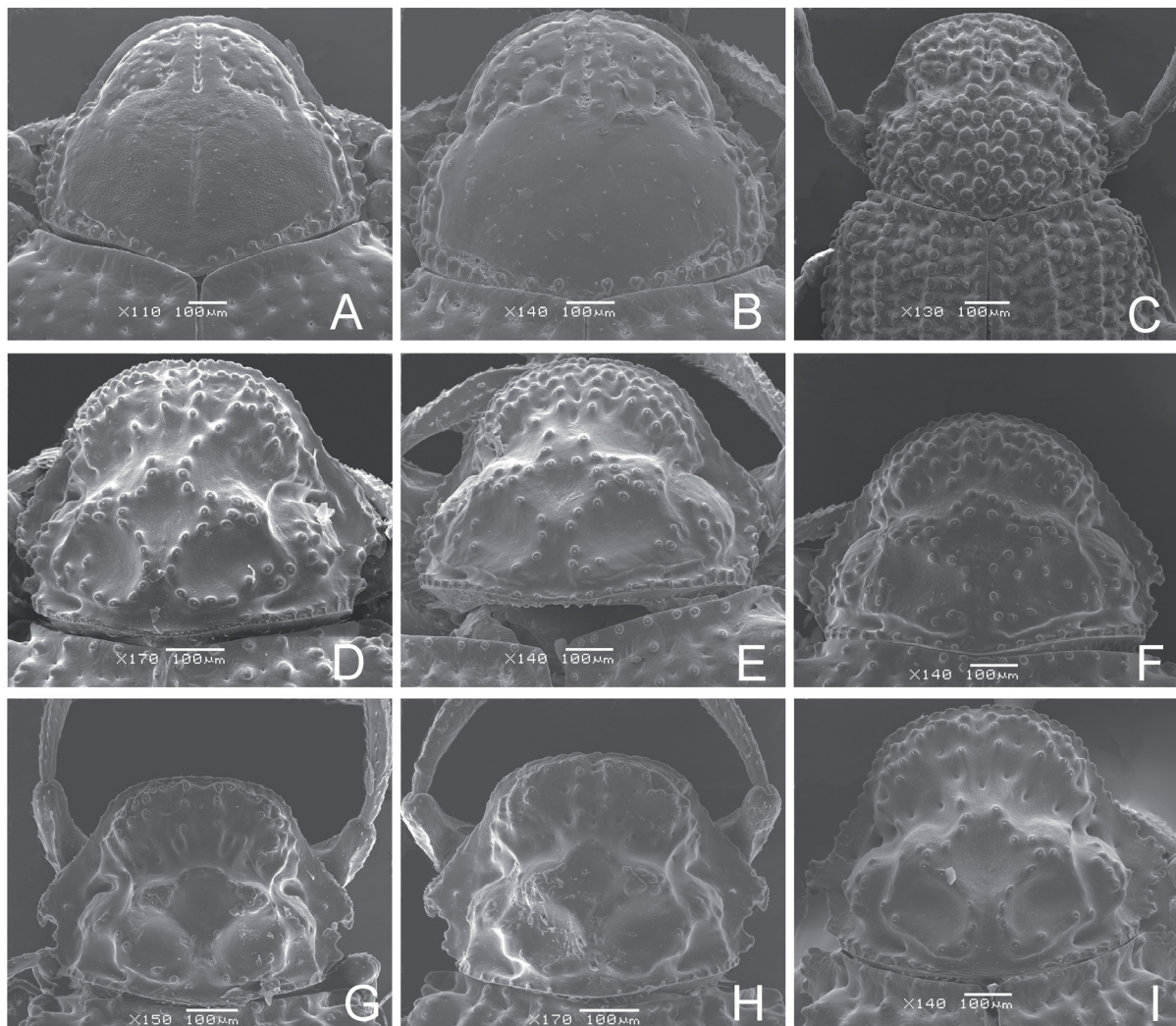


Fig. 7. Pronotum of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ni.) granulosus* Satô, 1972. **D.** *G. (Ne.) japonicus* Satô, 1972. **E–F.** *G. (Ne.) kurosawai* Nakane, 1963 from Hokkaido (E) and Nagano (F). **G–H.** *G. (Ne.) takahashii* sp. nov. from Kochi (G) and Okinawa (H). **I.** *G. (Ne.) satoi* sp. nov.

Table 2. Measurements of *Georissus* (*Neogeorissus*) spp.

	<i>G. (Ne.) japonicus</i> (N = 20)	<i>G. (Ne.) kurosawai</i> (N = 91)	<i>G. (Ne.) takahashii</i> sp. nov. (N = 55)	<i>G. (Ne.) satoi</i> sp. nov. (N = 13)
TL (mm)	1.26–1.82 (1.45)	1.44–2.10 (1.82)	1.20–1.66 (1.37)	1.30–1.58 (1.45)
EL (mm)	0.75–1.28 (0.98)	1.10–1.48 (1.18)	0.82–1.02 (0.93)	0.72–1.04 (0.90)
EW (mm)	0.80–1.10 (0.92)	0.94–1.38 (1.02)	0.72–1.08 (0.86)	0.94–1.08 (0.99)
PL (mm)	0.38–0.54 (0.47)	0.46–0.66 (0.55)	0.30–0.64 (0.44)	0.52–0.60 (0.56)
PW (mm)	0.60–0.82 (0.69)	0.60–0.96 (0.78)	0.54–0.82 (0.66)	0.70–0.82 (0.75)
PW/PL	1.28–1.77 (1.47)	1.09–1.68 (1.42)	1.19–1.93 (1.49)	1.24–1.50 (1.37)
EL/EW	0.82–1.17 (1.07)	0.98–1.43 (1.16)	0.90–1.36 (1.08)	0.75–1.02 (0.91)
EL/PL	1.44–2.37 (2.08)	1.88–2.91 (2.33)	1.59–3.13 (2.13)	1.24–1.93 (1.65)
EW/PW	1.21–1.45 (1.32)	1.27–1.80 (1.41)	1.08–1.59 (1.32)	1.23–1.39 (1.32)
TL/EW	1.38–1.76 (1.58)	1.45–1.92 (1.66)	1.35–1.94 (1.60)	1.35–1.56 (1.46)

Georissus (Neogeorissus) takahashii sp. nov.

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[Japanese name: Takahashi-marudoromushi]

Figs 2F, 5G–H, 6G–H, 7G–H, 8G–H, 9F–G, 10E, 11C, G; Table 2

Diagnosis

This species is easily distinguished from other Japanese species of *Georissus* by the elevated intervals 2, 4, 6.

Etymology

This species name is dedicated to Dr Keiichi Takahashi, the collector of the type series.

Material examined

Holotype

JAPAN – **Okinawa: Iriomote-jima** • ♂; Nishifunatsuki-gawa; 23 Oct. 1995; K. Takahashi leg.; EUMJ.

Paratypes

JAPAN – **Shikoku: Kochi Pref.** • 2 ex.; Shimanto-shi, Shimoda-Tadenogawa; 27 Jul. 2009; T. and T. Miyata leg.; EUMJ • 24 ex.; Shimanto-shi, Shimanto-gawa; 23 Jul. 2011; T. and T. Miyata leg.; EUMJ. – **Okinawa: Okinawa-jima** • 1 ex., Isagawa, Nago-shi; 1 Sep. 2021; M. Nagatsuka leg.; light trap; HOWP • 1 ex.; Nago-dake, Nago-shi; 22 Jun. 2006; T. Kato leg.; EUMJ. – **Okinawa: Ishigaki-jima** • 1 ex.; Takeda-rindo; 24°24'11.557" N, 124°10'01.638" E; 150 m alt., 25 Jun. 2010; T. Shimada leg.; EUMJ • 11 ex.; Takeda-rindo; 24°24'13.597" N, 124°10'49.973" E; 140 m alt.; 25 Jun. 2010; T. Shimada leg.; EUMJ • 1 ex.; Omoto-rindo; 23 Mar. 1995; M. Kimura leg.; EUMJ • 3 ex.; Omoto-rindo; 26 Mar. 1996; K. Takahashi leg.; EUMJ • 2 ex.; 23 Oct. 1995; K. Takahashi leg.; EUMJ. – **Okinawa: Iriomote-jima** • 4 ex.; Nishifunatsuki-gawa; 24 Mar. 1995; M. Kimura leg.; EUMJ • 2 ex.; Takeda; 26 Oct. 1998; K. Takahashi leg.; EUMJ • 3 ex.; Taisho-ike; 25 Aug. 1994; M. Satô leg.; EUMJ • 2 ex.; Taisho-ike; 26 Aug. 1994; M. Satô leg.; EUMJ • 1 ex.; Airagawa-rindo; 2 Mar. 1998; I. Matoba leg.; EUMJ • 1 ex.; Ohtomi; 20 Nov. 2003; Y. Hirano leg.; EUMJ.

Description

COLORATION (Fig. 2F). Light reddish brown, matt. Body surface often covered with greyish to white substance.

HEAD (Fig. 6G–H). Clypeus uneven, bearing a few large granules sparsely on median portion; *slr* consisted of granules, anterior granules distinct, but posterior ones indistinct; reaching to posterior third of frons, posteriorly connected to *smb* by an arc of sparsely arranged granules and formed a pair of rounded foveae; *smb* consisted of tubercles and granules; *lsa* with small indistinct granules sparsely.

PRONOTUM (Fig. 7G–H). Relatively small, widest in the anterior third. Anterior portion provided with granules and pits sparsely; anterior margin slightly crenellated; *smlg* relatively narrow, provided with

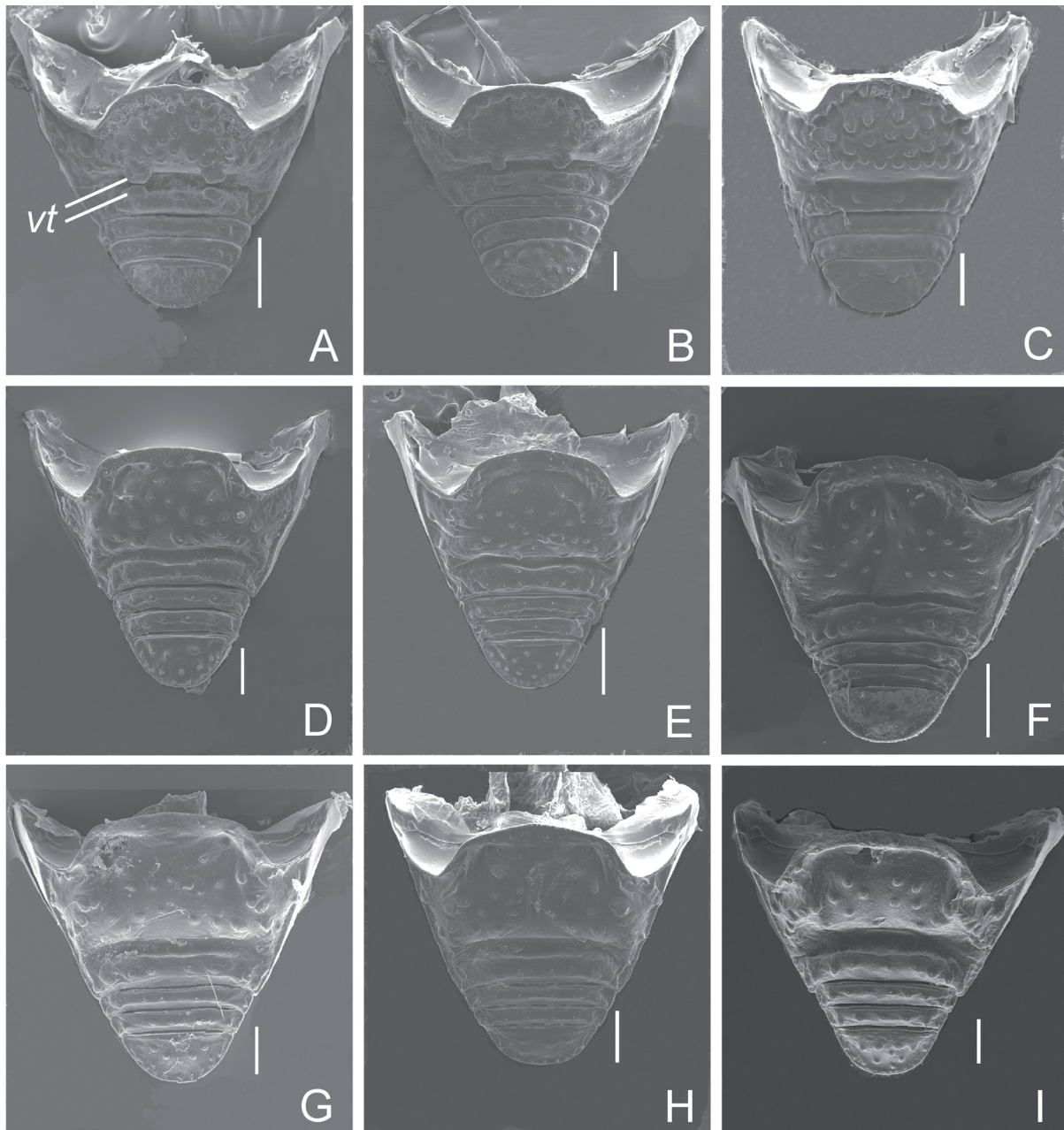


Fig. 8. Ventrites of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ni.) granulosus* Satô, 1972. **D.** *G. (Ne.) japonicus* Satô, 1972. **E–F.** *G. (Ne.) kurosawai* Nakane, 1963 from Hokkaido (E) and Nagano (F). **G–H.** *G. (Ne.) takahashii* sp. nov. from Kochi (G) and Okinawa (F). **I.** *G. (Ne.) satoi* sp. nov. Abbreviation: *vt* = ventral teeth. Scale bars = 100 μ m.

longitudinal row of small pits. Posterior portion strongly convex than anterior portion; *cd* rhomboid and large, with granules on only lateral portion; *sdp* oblong oval, larger than *cd*, with a few granules; *sfb* poorly developed, with indistinct granules; *pg* wide and triangular, not reaching median portion of *sdp*; *sdn* well developed, having a few teeth.

ELYTRA. Humeral bulges distinct, bearing granules. Intervals 2, 4, 6 highly elevated, with distinct granules. Elytral punctures regular square, seriate and distinct. Lateral ridges on each elytron highly elevated, bearing distinct granules. Hind wings fully developed.

ABDOMEN (Fig. 8G–H). Lateral margin of ventrites uniformly narrowing posterior. Ventrite 1 with small and sparse granules. Granulation of ventrites 2–5 indistinct.

MALE GENITALIA (Fig. 9F–G). Aedeagus 0.32 mm long. Parameres shorter than phallobase, their basal portions combined as wide as anterior portion of phallobase; lateral margins bulbous at basal portion. Median lobe longer than parameres, widening basally, obtuse at apex; basal struts long. Phallobase about 2.2 times as long as wide, subparallel-sided; posterior portion with large basal foramen.

FEMALE GENITALIA. Latero-tergites 8 (Fig. 10E) forming obtuse angle; apex strongly incurved. Setae of gonostylus short. Spermatheca (Fig. 11G) curved oval, relatively narrowing at apical portion. Bursal sclerite (Fig. 11C) large and almost symmetrical, slightly sclerotized.

Biological notes

This species was collected under rocks near a river (Y. Hisasue pers. com.). Specimens from Kochi Prefecture were collected using a car net trap.

Distribution

Japan: Shikoku (Kochi Pref.), Okinawa (Okinawa-jima, Ishigaki-jima, Iriomote-jima) (Fig. 13).

Georissus (Neogeorissus) satoi sp. nov.

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[Japanese name: Satô-marudoromushi]

Figs 2G, 5I, 6I, 7I, 8I, 9H, 10F, 11D, H; Table 2

Diagnosis

This species is easily distinguished from other Japanese species of *Georissus* by the dark reddish body and body shape; elytra projecting laterally; granules on elytra projecting and forming serration. This species resembles *G. lateralis* Delève, 1969 and *G. calculus* Delève, 1967, and is distinguished from them by more arcuate in lateral margins of parameres (Delève 1967b, 1969). *Georissus smetanai* Fikáček, 2012, leaf litter inhabiting species described from Sabah, Malaysia is also similar to *G. satoi* sp. nov., but the granulation on the pronotum is different (Fikáček 2012).

Etymology

This species name is dedicated to the late Dr Masataka Satô, who made a great contribution to entomology in Japan.

Material examined

Holotype

JAPAN – Okinawa: Ishigaki-jima • 1ex.; Yonehara; 20 Oct. 1998, K. Takahashi leg.; EUMJ.

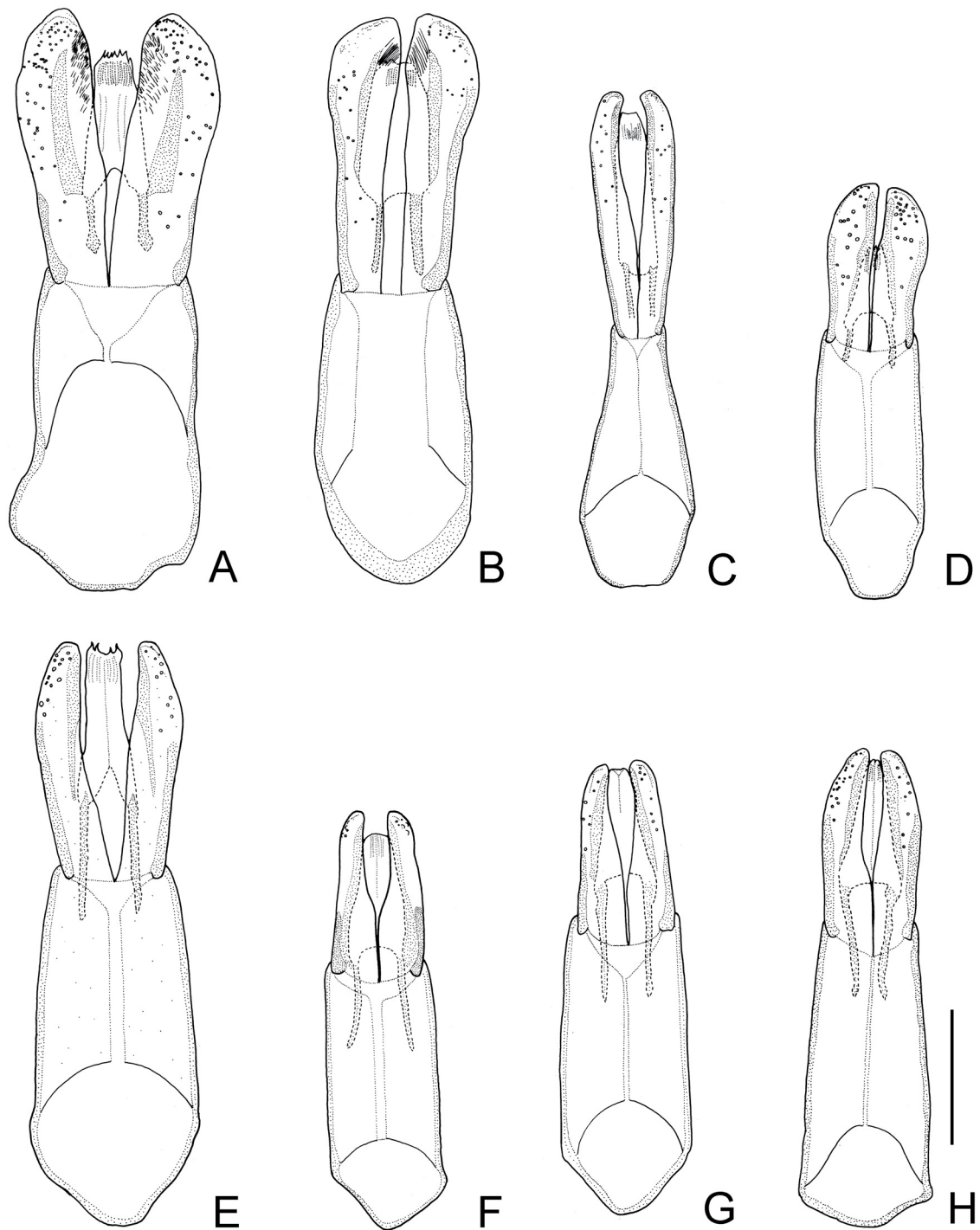


Fig. 9. Male aedeagus of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ni.) granulatus* Satô, 1972. **D.** *G. (Ne.) japonicus* Satô, 1972. **E.** *G. (Ne.) kurosawai* Nakane, 1963. **F–G.** *G. (Ne.) takahashii* sp. nov. from Kochi (F) and Okinawa (G). **H.** *G. (Ne.) satoi* sp. nov. Scale bar = 0.1 mm.

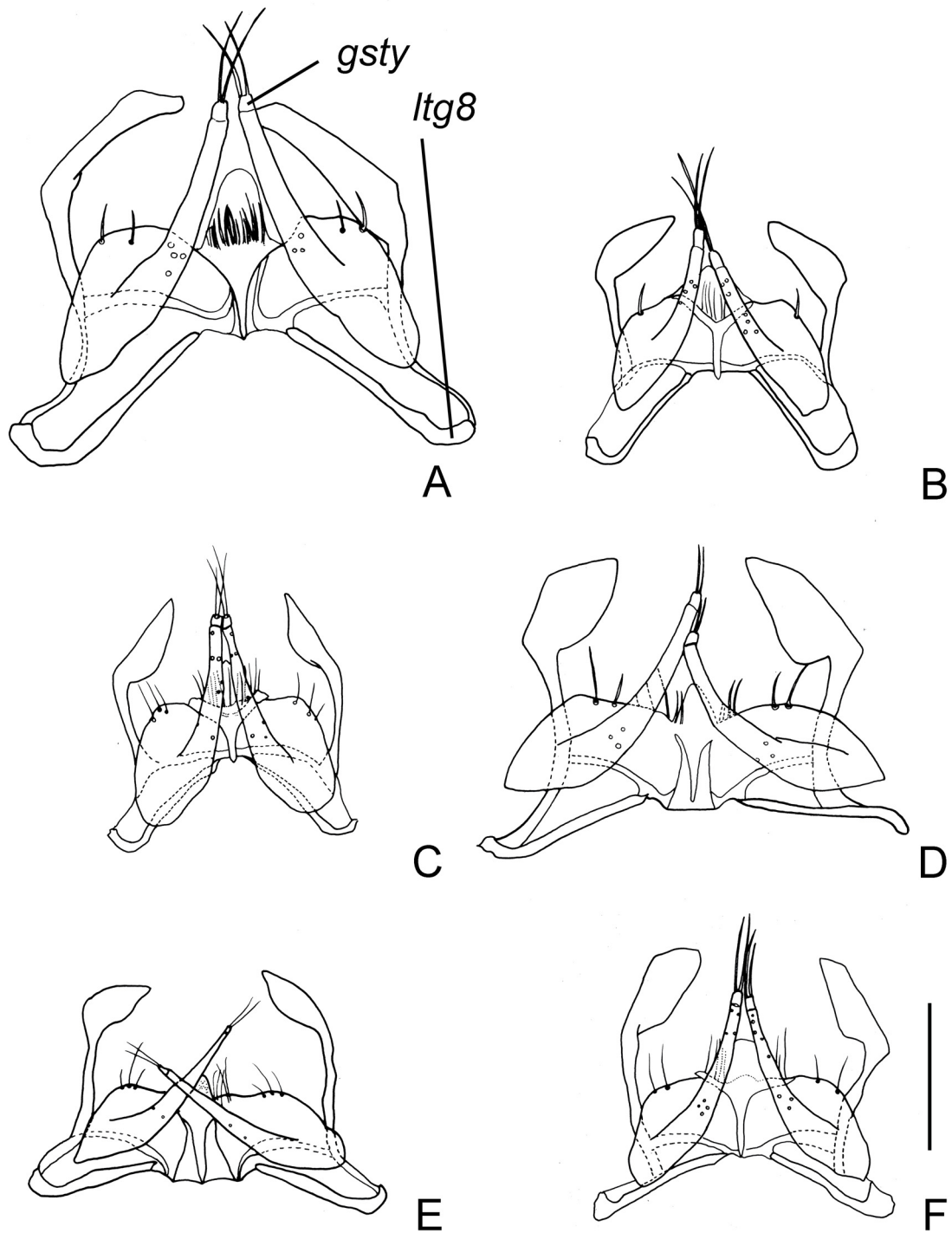


Fig. 10. Female ovipositor of *Georissus* spp. **A.** *G. (G.) canalifer* Sharp, 1888. **B.** *G. (G.) babai* Satô, 1970. **C.** *G. (Ne.) japonicus* Satô, 1972. **D.** *G. (Ne.) kurosawai* Nakane, 1963. **E.** *G. (Ne.) takahashii* sp. nov. **F.** *G. (Ne.) satoi* sp. nov. Abbreviations: *gsty* = gonostylus; *ltg8* = latero-tergite 8. Scale bar = 0.1 mm.

Paratypes

JAPAN – Shikoku: **Kagawa Pref.** • ♂; Takamatsu-shi, Nishiueda-machi; 20 Apr. 2020; Y. Waki leg.; EUMJ. – **Okinawa: Ishigaki-jima** • 3 ex.; Buzama-dake; 17 Oct. 1998; K. Takahashi leg.; EUMJ • 1 ex.; Omoto-tunnel; 11 Dec. 1998; K. Takahashi leg.; EUMJ • 1 ex.; Banna-dake; 22 Oct. 1998; K. Takahashi leg.; EUMJ • 2 ex.; Yonehara; 5 Dec. 1998; K. Takahashi leg.; EUMJ • 3 ex.; Urazoko-rindo; 27 Sep. 1998; K. Takahashi leg.; EUMJ • 1 ex.; Yonehara; 17 Oct. 1998; K. Takahashi leg.; EUMJ. – **Okinawa: Iriomote-jima** • 1 ex.; Taketomi-cho, Sonai-dake; 10 May 2012; T. Yoshida leg.; EUMJ.

Description

COLORATION (Fig. 2G). Dark red, weakly shining. Body surface often covered with white substance.

HEAD (Fig. 6I). Clypeus uneven, bearing large granules in median portion, and small granules; *slr* consisted of granules, granulation of anterior portion dense, in contrast to posterior portion sparse; *smb* consisted of granules and large tubercles, narrowing posteriorly; *lsa* with small indistinct granules at anterior portion.

PRONOTUM (Fig. 7I). Relatively large, widest at the middle; anterior margin crenellated; *smlg* relatively wide, granulation sparse, bearing a few small pits. The first half of anterior portion provided with granules densely, in contrast to the last half bearing pits sparsely. Posterior portion strongly convex than anterior portion; *cd* rhomboid and large, surrounded by granules; *sdp* oblong oval, larger than *cd*, surrounded by granules sparsely; *slr* strongly developed, with large granules; *pg* relatively wide and short, not reaching median portion of *sdp*; *sdn* well developed, provided with many teeth.

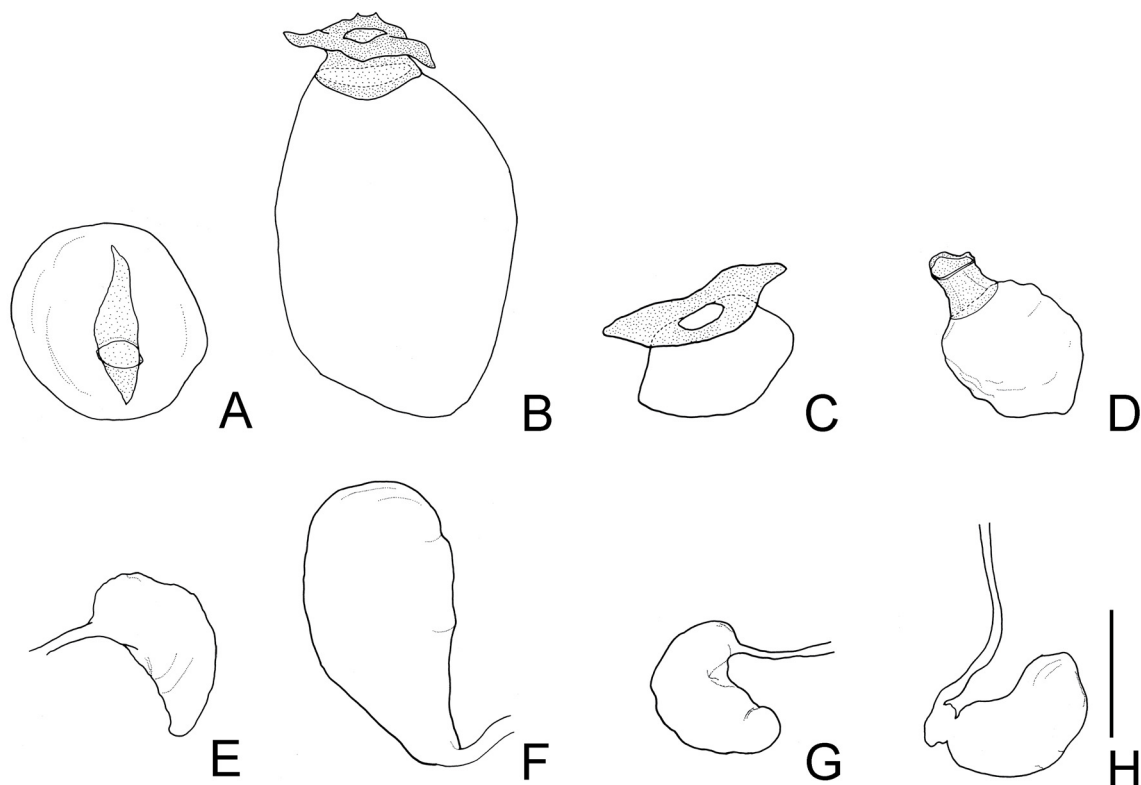


Fig. 11. Female genital organs of subgenus *Neogeorissus* spp. **A–D.** Bursal sclerite. **E–H.** Spermatheca. **A, E.** *G. (Ne.) japonicus* Satô, 1972. **B, F.** *G. (Ne.) kurosawai* Nakane, 1963. **C, G.** *G. (Ne.) takahashii* sp. nov. **D, H.** *G. (Ne.) satoi* sp. nov. Scale bar = 0.1 mm.

ELYTRA. Widest at the middle, slightly wider than pronotum in basal margin; suture and all intervals slightly elevate, regularly bearing distinct granules; granulation projecting and forming serration; punctures distinct and regular. Humeral bulges indistinct. Lateral ridges on each elytron highly elevate, bearing distinct granules. Hind wings not developed.

ABDOMEN (Fig. 8I). Lateral margin of ventrites uniformly narrowing posterior. Ventrite 1 with large and sparse granules; serial small bulges arising at anterior margin of ventrite 1 and forming ridge. Granulation of ventrites 2–5 distinct and sparse.

MALE GENITALIA (Fig. 9H). Aedeagus 0.35 mm long. Parameres shorter than phallobase, their basal portions combined as wide as anterior portion of phallobase; lateral margins slightly curved at median portion; internal margins slightly bulbous at basal portion. Median lobe longer than parameres, widening basally, angular at apex; basal struts long. Phallobase about 2.5 times as long as wide, slightly widening posteriorly; posterior portion with large basal foramen.

FEMALE GENITALIA. Latero-tergites 8 (Fig. 10F) forming obtuse angle; apex strongly incurved. Setae of gonostylus long. Spermatheca (Fig. 11H) elongated oval, constricted at basal portion. Bursal sclerite (Fig. 11D) large and almost symmetrical, slightly sclerotized.



Fig. 12. Living individuals (A, C) and habitat (B, D) of *Georissus* spp. **A–B.** *G. (G.) canalifer* Sharp, 1888 in Hokkaido; **C–D.** *G. (Ne.) kurosawai* Nakane, 1963 in Ehime. Photographs by HY (A–B) and KY (C–D).

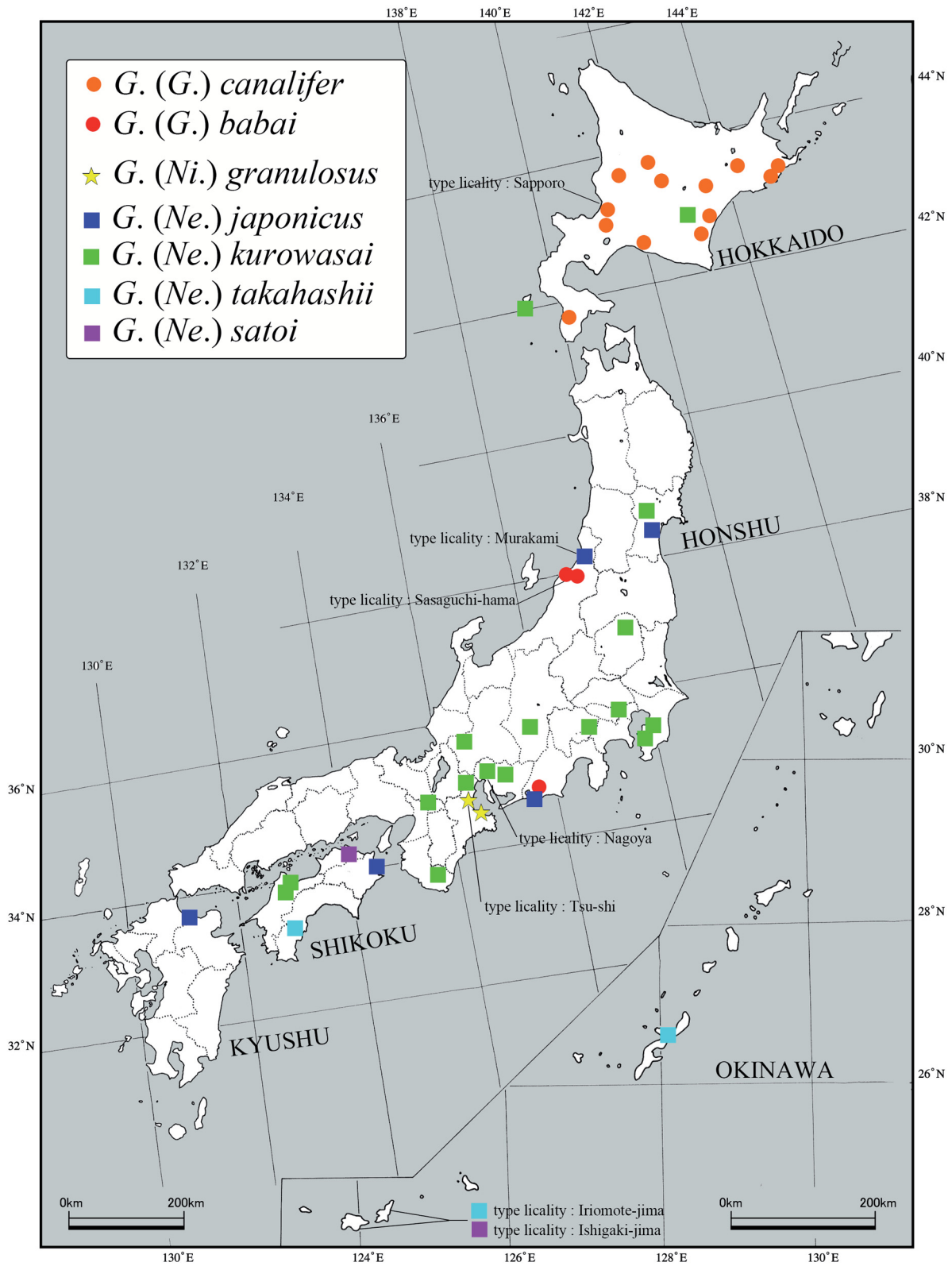


Fig. 13. Distribution map of *Georissus* spp. Russian localities for *Georissus (G.) canalifer* Sharp, 1888 and *G. (Ne.) japonicus* Satô, 1972 are omitted.

Biological notes

This species was collected from leaf litter (T. Yoshida pers. comm.).

Distribution

Japan: Shikoku (Kagawa Pref.), Okinawa (Ishigaki-jima, Iriomote-jima) (Fig. 13).

Discussion

In this study, we added two new species from Japan. These species were found in southwest Japan, where it is expected that additional species will be found, particularly inhabitants of leaf litter in wet environments like as *G. satoi* sp. nov. Some specimens thought to belong to an undescribed taxon were obtained from Amami-Oshima Island, but we do not describe them in this study because there are few specimens, and in poor condition.

One species, *G. formosanus* Kono, 1936, has been described from Taiwan, but the type specimen could not be examined and was not included in this study. According to the original description (Kono 1936), this species is considered to be closely related to *G. (Ne.) japonicus*.

Acknowledgements

We would like to express our gratitude to the late Dr Masataka Satô for his kind support. We express thanks to Makiko Fukui (Ehime University) for taking SEM photographs used in this paper, and to Masahiro Ohara (SEHU), Keiichi Takahashi (Tsukuba), Shigehisa Hori (Hokkaido Museum), Katsumi Akita (Tsu), Takahiro Yoshida (Tokyo Metropolitan University), Yasuhiro Utsunomiya (Takamatsu), Yu Hisasue (Kyushu University), Masato Mori (Kankyo Kagaku Osaka Co., Ltd), Yuta Waki (Kagawa University) and Masakazu Hayashi (HOWP) for providing specimens. We also thank two anonymous reviewers for their helpful guidance through the process of revision of this article.

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Manuscript received: 21 September 2021

Manuscript accepted: 15 February 2022

Published on: 3 May 2022

Topic editor: Tony Robillard

Section editor: Max Barclay

Desk editor: Pepe Fernández

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